

Aggression and Impulsivity: Two of a kind ?

Citation for published version (APA):

Tonnaer, F. M. C. L. (2018). *Aggression and Impulsivity: Two of a kind ? Theory, provocation paradigms and neurocorrelates of aggression and impulsivity in a forensic population*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20181220ft>

Document status and date:

Published: 01/01/2018

DOI:

[10.26481/dis.20181220ft](https://doi.org/10.26481/dis.20181220ft)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

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Valorization Addendum

In this dissertation we aimed firstly to provide conceptual clarification about the main concepts of interest, namely (reactive) aggression and impulsivity. Secondly, we aimed to unravel the neurocognitive and vulnerability factors of aggression and impulsivity in a forensic population. Therefore, in this dissertation we start with definitions, assessment models and suggestions for interventions regarding aggression and impulsivity. Followed by neurocognitive findings from neurological, behavioral and brain imaging tests of provoked reactive aggression. The theoretical and practical implications of our findings were described in the various chapters throughout this thesis. In this valorization addendum we discuss the societal value of the research methods and findings of the present thesis.

Societal and economic relevance

In the Netherlands, as in the rest of Europe, 3% of all global burden of disease (GBD) (or cause-specific mortality, Wang et al., 2016) is a result of injury by violence or aggression. The cost of injury due to aggression has been estimated up to € 30 million yearly in medical costs and € 66 million in absenteeism costs because of an injury by violence (Snijders et al., 2016). In the case of forensic offender samples as recruited in the dissertation research, the prevalence of maladaptive aggression tends to be specifically high (Connor, 2002), as is the proneness towards aggression (Smith & Waterman, 2003). Also, the prevalence of pathological impulsivity is extremely high in forensic offenders (up to 88%; Bjørkly, 2006). In the literature the definitions and conceptualizations of both reactive aggression and impulsivity do overlap (García-Forero et al., 2009), but research indicates that impulsivity is a key risk factor for (reactive) aggressive behavior (Pratt & Cullen, 2000; Vazsonyi & Belliston, 2007) and violent crime (Scarpa & Raine, 2000). Subsequently, more insight in uniform conceptualizations and possible vulnerability factors for reactive aggression is of particular importance for understanding and treating forensic offender samples. At the very least, the types of aggressive acts that are assumed to be related to impulsivity vary greatly. For instance, impulsivity might be involved in acting out sexual drive (in various sexual disorders), compulsive drive (e.g., in kleptomania), or explosive anger outbursts (in *intermittent explosive disorder*; American Psychiatric Association (APA), 2013). Furthermore, it is questionable whether all variances of impulsive behavior require the same risk management strategy in preventing recidivism (Byrne & Roberts, 2007; Douglas et al., 2014).

In essence, in order to get a better understanding about the concepts of impulsivity and aggression, it is essential to disentangle the different concepts and definitions (García-Forero et al., 2009). This is especially important in relation to forensic offender populations, since these different facets of impulsivity all relate to various forms of psychopathology (Fields et al., 2015).

and (violent) recidivism risk, but not necessarily through the same process. Moreover, they might have a different cause. In chapter 4 we describe of the role of different impulsivity dimensions as possible vulnerability factors for aggression in forensic patients. In the following chapters we focus on aggression, anger provocation and anger regulation in a violent population. And the general discussion of this thesis gives a more detailed description of the theoretical, clinical, and research implications of our findings and provides directions for future research.

Target groups

First, the results are relevant for forensic offenders and their relatives because research results might give them more insight into the mechanisms of (reactive) aggression and impulsivity usable in reflective regulation of anger, reducing aggressive responses. Second, the results of this thesis are relevant for forensic health care professionals by providing new insights for effective treatment. Third, the current results are of interest for researchers in the field of forensic practice, impulsivity and aggression to verify and refine theoretical models. And fourth, we hope that the results of this thesis ultimately help society to lower the (social) costs of injury by violence or aggression.

Approach

The design of the studies described in this thesis have been evaluated as PhD research proposal for the Experimental Psychopathology (EPP) research school, as a project proposal for the ethical commission of Maastricht University, as a project proposal for the scanner lab Brains Unlimited scanner staff, and discussed with forensic health care professionals. For instance the design of different behavioural measurements of impulsivity has been subject of discussion with the psychomotor therapists.

During the execution of this dissertation research, various assessment methods have been tested. For example, the development of the multidimensional impulsivity construct started with brainstorm sessions within the forensic clinic searching for various assessment measures of all impulsivity dimensions. This resulted in new, non-consensus assessment methods as jumping mattresses measuring risk taking and self-control. However, scoring results of these methods as well as some known assessments as the Iowa Gambling task indicated unreliable results for a substantial part of the subject sample. Consequently, (and unfortunately) these methods were not included within the final impulsivity model analyses.

Activities and service

As already noted, in this thesis we aim to provide conceptual clarification about (reactive) aggression and impulsivity and to unravel the neurocognitive and vulnerability factors of aggression and impulsivity in a forensic population. Therefore, a clarification of the different definitions is provided within **chapter 1** of this dissertation, assessment models (see **chapter 2** and **chapter 3** for more detailed information) and suggestions for more effective treatment interventions regarding aggression and aggression regulation.

More specific, in **chapter 2** we describe a multidimensional model of impulsivity and the predictive validity of distinct impulsivity dimensions for psychopathology. With impulsivity as a crucial target for diagnosis and interventions, a combination of past research results combined with the current results led to the preference of a four-dimensional model of impulsivity resulting in the following dimensions: impulsive decision making (reflecting acting without thinking and nonplanning), sensation seeking (reflecting a risk appetite and venturesomeness), (inadequate) response inhibition (reflecting response inhibition dysfunction), and sustained attention (reflecting perseverance). The current results signal the importance to consider impulsivity as a multidimensional construct for clinical practice.

Moreover, our results show differences in provocation sensitivity between forensic psychiatric offenders and penitentiary offenders. While forensic psychiatric offenders showed significant more anger response statements while provoked with angers stories (ATSS; Davison, Robins, & Johnson, 1983, see **chapter 3** for more detailed information), penitentiary offenders showed significant more reactive aggression provoked by a Body Opponent Bag (BOB) with harassing feedback. Consequently, future research should carefully select provocation paradigms proven to be effective in a violent offender subsample with equal characteristics. In the forensic psychiatric offenders provocation response was related to automatic cognitive biases towards anger and psychopathy. In the penitentiary group provocation response was related to aggressive behavioral intentions, anger control problems, and self-reported aggression. Consequently, it would be informative to investigate which automatic cognitive biases towards anger relate to recidivism risk within forensic offenders with psychopathic characteristics. Further, these specific angers stories could be utilized as a supplemented assessment tool exploring cognitive biases towards anger, subsequently providing input for treatment.

In addition, the current results in **chapter 3** showed that venting anger is effective in reducing aggression, at least in the forensic psychiatric offenders. However, following results of **chapter 5 and 6** regarding fMRI research on anger provocation and regulation, showed regulation difficulties in violent (forensic psychiatric) offenders, with an increased initiation to (implicitly) regulate during anger provocation. The constant effort required for violent offenders to regulate anger might exhaust the necessary cognitive resources, resulting in a risk for self-control failure. Therefore, venting anger in a controlled setting like during psychomotor therapy could be helpful for the forensic psychiatric group reducing aggressive feelings and behaviors, preventing cognitive exhaustion when provoked.

Innovation

In this dissertation we aimed to investigate whether (forensic psychiatric) offenders do show different brain responses during emotion provocation. Therefore, we examined differences within brain responses between violent offenders and matched healthy controls during emotion provocation using fMRI technique. The assessment methods included not only self-reports but also behavioral measurements, and different innovative emotion provocation

paradigms that have been adapted for fMRI usage measuring brain responses. This is innovative because previous cognitive research using brain imaging techniques focused on frustration, punishment (Dambacher et al., 2015; Emmerling et al., 2015) or perceived threat as a trigger of anger or aggression (Blair, 2012), emotion research has focused on the recognition of anger as an indicator for dysfunctions in anger experience and perception (Kret & de Gelder, 2013; Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012), with deficits in emotion recognition ultimately leading to aggressive and violent behaviour (Howells et al., 2002). In other words, earlier studies using fMRI in violent offenders focused on the recognition of anger (e.g. perception of emotional pictures) (Bueso-Izquierdo et al., 2016; Werner, Kühnel & Markowitsch, 2013) and automatic action tendency responses (avoid anger and approach happy) to facial expressions (Volman et al., 2016). Up until now no fMRI study actually investigated anger provocation and anger regulation within a group of violent offenders exhibiting anger problems and compared them to non-offender controls.

Finally, the current thesis is the first to investigate actual brain response differences in emotion (anger and happy) provocation compared to regulation within a group of violent offenders exhibiting anger problems and compared them to non-offender controls (**chapter 6**). To understand the mechanism underlying the regulation of aggressive behavior the present thesis is unique in examining anger expression in both violent offenders and non-offender controls during provocation as well as regulation. Therefore, the results in **chapter 6** provide new insights for the development of effective treatment interventions for reactive aggression.

Knowledge dissemination and communication

Transfer of the practical skills needed for the process of conducting the studies (e.g., impulsivity measures, clinical semi-structured interviews based on the Diagnostic and Statistical Manual) has taken place via teaching (i.e., internships). The outcomes of the studies have been and will be communicated within scientific community by international peer-reviewed journal publications and national and international conferences. The outcome of each study described in this thesis has been presented to participants and staff of the Forensic Psychiatric Center (FPC) and the Penitentiary Psychiatric Centre (PPC) in separate meetings followed by discussions on the impact of the results for clinical practice. Further, communications outside the scientific field have been published in the (local) media.

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